DOE/EA-1339-A

Environmental Assessment Addendum
Disposition of Additional Waste at the Paducah Site

December 2003

U. S. Department of Energy
Oak Ridge Operations
Oak Ridge, Tennessee

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Acronyms

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DMSA	DOE Material Storage Area
DOE	U.S. Department of Energy
EA	Environmental Assessment
g	Grams
HDDV	Heavy Duty Diesel-Powered Vehicle
LCF	Latent Cancer Fatality
m^3	Cubic Meters
MEI	Maximally Exposed Individual
NCS	Nuclear Criticality Safety
NEPA	National Environmental Policy Act of 1969
PM_{10}	Particulate Matter Smaller than 10 Micrometers
ROD	Record of Decision

1.0 Introduction

The U.S. Department of Energy (DOE) proposes disposition activities for waste from the Paducah Site in Paducah, Kentucky. As a federal agency, DOE must comply with the National Environmental Policy Act of 1969 (NEPA) by considering, in the decision-making process, potential environmental impacts associated with its proposed action. The Council on Environmental Quality promulgated regulations to implement NEPA [40 *Code of Federal Regulations* (*CFR*) 1500 et seq.] and directed federal agencies to develop their own implementing regulations. DOE regulations (10 *CFR* 1021) provide additional direction for conducting NEPA reviews of proposed DOE activities. This environmental assessment (EA) addendum for the disposition of DOE waste stored and/or generated at the Paducah Site has been prepared in accordance with both Council on Environmental Quality and DOE regulations and with DOE orders and guidance regarding these waste types.

1.1 Purpose and Need for Agency Action

DOE must continue to manage (i.e., treat, store, and dispose) its waste and material safely, efficiently, and cost effectively in compliance with applicable federal and state laws and in a manner protective of human health and the environment.

DOE is required by the Atomic Energy Act (42 United States Code 2011 et seq.) and DOE Order 435.1A to manage the radioactive wastes that it generates. DOE has determined that it will dispose low-level radioactive waste at the DOE Hanford Site in Washington and at the DOE Nevada Test Site, as documented in the *Record of Decision (ROD) for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste* (January 1998, 63 *Federal Register* 3629). This decision does not preclude treatment or disposal of low-level waste at commercial facilities in accordance with DOE policy.

DOE completed an *Environmental Assessment for Waste Disposition Activities at the Paducah Site Paducah Kentucky* (DOE/EA-1339 - Waste Disposition EA) and issued a Finding of No Significant Impact on November 4, 2002. The Waste Disposition EA analyzed disposition of approximately 11,000 m^3 of various wastes. At the time of issuance of the Waste Disposition EA, DOE anticipated that the removal of remaining waste stored on-site (estimated at 20,000 m^3 in that EA) would be conducted as part of decontamination and decommissioning (D&D) activities under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Consequently, the Waste Disposition EA included the characterization of these wastes but did not include these additional wastes in the evaluation of off-site disposition activities.

DOE has subsequently decided to propose proceeding with disposition of additional materials and wastes as part of its recently funded accelerated cleanup plan rather than waiting until facility D&D. Much of the additional material and waste is stored outdoors where there is a risk of spread of contamination to the environment. Also, DOE would experience a long-term cost savings through reduction of surveillance and maintenance costs that would be necessary for continued on-site storage.

1.2 Scope of this Assessment

DOE proposes to disposition approximately 17,600 m^3 of material in addition to the 11,000 m^3 of waste analyzed in the Waste Disposition EA for a total of 28,600 m^3 of waste and material. The majority of these materials are currently stored in approximately 160 DOE Material Storage Areas (DMSAs) at the Paducah Site. All of these materials will be characterized to determine if they are wastes and, if so, how they are to be dispositioned (i.e., categorized, managed, and treated or disposed).

DOE anticipates that a substantial portion of the material will be characterized as waste. DOE further anticipates that approximately 45% (7,900 m^3) of the material will be waste that meets the permit conditions and Waste Acceptance Criteria for on-site disposal in the C-746-U Landfill. No low-level radioactive or hazardous waste would be put in the landfill. On-site disposal of waste, which may include authorized limits material, is evaluated in the *Environmental Assessment for the Construction, Operation, and Closure of the Solid Waste Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/EA-1046) and *The Environmental Assessment on the Implementation of the Authorized Limits Process for Waste Acceptance at the C-746-U Landfill Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/EA-1414) and is not further evaluated in this EA Addendum.

Low-level Waste – Radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the *Atomic Energy Act of 1954,* as amended), or naturally occurring radioactive material (DOE G 435.1-1).). Low-level waste can be evaluated to determine if the material meets the requirements of the approved authorized limits.

Authorized Limits Material – Residual radioactive material that meets the requirements of the approved authorized limits developed in accordance with DOE Standard 5506-99 (Guide to Good Practice for Establishing Authorized Limits for the Release of Waste Containing Residual Radioactivity) and DOE Order 5400.5 (Radiation Protection of the Public and the Environment).

This EA Addendum evaluates the potential impacts to human health and the environment that would result from the Proposed Action and alternatives and it is intended as a supplement to the Waste Disposition EA. Evaluation of impacts from the operation of off-site waste treatment and disposal facilities is discussed in the Waste Disposition EA (p. 6) and, consequently, is not further evaluated in this EA Addendum.

2.0 Proposed Action

DOE proposes to disposition 11,000 m^3 of waste as described in the Waste Disposition EA and approximately 17,600 m^3 of additional material currently stored at the Paducah Site for a total of 28,600 m^3 of waste and material. Disposition activities for the additional material include characterization, storage, packaging, loading, and shipping wastes to disposal locations.

For purposes of impact evaluation, DOE has established a "worst-case scenario" for the Proposed Action whereas all 28,600 m^3 is considered low-level radioactive waste requiring transportation off-site for treatment or disposal. The additional waste would be transported in the same timeframe, same manner, same representative locations, and same representative routes as described in the Waste Disposition EA. DOE currently anticipates that the waste would be disposed primarily at the DOE Nevada Test Site although disposition at the Hanford Site and commercial facilities, such as Envirocare of Utah, Inc. and Waste Control Specialists, LLC in Texas, are also analyzed as possible locations.

Most of the additional material is currently stored in approximately 160 DMSAs at the Paducah Site. Due to the undetermined nature of a majority of the DMSA wastes, Nuclear Criticality Safety (NCS) characterization must first be performed. NCS characterization provides the information necessary to move or manage materials safely without the threat of uncontrolled nuclear criticality. The material must also be examined to determine if any Resource Conservation and Recovery Act or Toxic Substances Control Act regulated wastes are present. Material would not be available for disposition until DMSA characterization activities are completed. DOE anticipates this characterization could occur over a 10-year period. Material would be disposed throughout the 10 years as portions of the characterization are completed.

2.1 No Action Alternative

Under this alternative, the additional low-level waste would be stored on-site until removed during D&D activities. The activities associated with the continued storage of the low-level waste are the same as those described in the Proposed Action in the Waste Disposition EA.

2.2 Enhanced Storage Alternative

The activities associated with enhanced storage would be similar to those described in Enhanced Storage Alternative in the Waste Disposition EA.

2.3 Alternatives Considered but Dismissed

2.3.1 Onsite Disposal of all Waste

DOE considered the option to dispose all wastes on-site. This action would result in the need to build a new landfill or landfill cells for disposal of low-level waste. This alternative was not considered reasonable. Based on the *Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Waste* (January 1998, 63 *Federal Register* 3629), DOE has determined that low-level waste should be disposed either at the Nevada Test Site or the Hanford Site rather than constructing new landfills or landfill cells. (The Record of Decision did not preclude disposal at commercial facilities.)

3.0 Affected Environment

The affected environment description in the Waste Disposition EA is still valid and has not changed. The additional 17,600 m^3 of low-level waste are currently stored both outdoors and indoors at the Paducah Site. The only on-site activities planned for the additional low-level waste would be storage, surveillance, characterization, packaging, repackaging, and loading onto transport carriers. All of these activities are analyzed in the Waste Disposition EA. Therefore, the affected environment is the same for this EA Addendum as for the Waste Disposition EA.

4.0 Environmental Consequences

4.1 Proposed Action Impacts

Potential environmental impacts that could result from the Proposed Action (using the worst-case scenario described above) were evaluated for the following: land use, geology and seismicity, soils and prime farmland, water resources and water quality, groundwater, floodplains, wetlands, ecological resources, threatened and endangered species, noise, cultural resources, archaeological resources, Native American resources, air quality, socioeconomics and environmental justice, on-site accidents, transportation, and transportation accidents.

Potential impacts identified were compared with the impacts identified in the Waste Disposition EA. There would be no change for impacts to: geology and seismicity, soils and prime farmland, water resources and water quality, groundwater, floodplains, wetlands, noise, cultural resources, archaeological resources, Native American resources, air quality, and on-site accidents. These impacts were not analyzed further in this EA Addendum.

Impacts of land use, socioeconomics, environmental justice, transportation, and ecological resources may change from the Waste Disposition EA as a result of disposition of the additional material, and are evaluated further in this EA Addendum. The biological assessment prepared for the Waste Disposition EA to evaluate potential impacts on federally listed species was revised to fully incorporate the Proposed Action. The revised biological assessment concludes that there will be no adverse affect on federally listed species or critical habitat of these species (Appendix C).

4.1.1 Land Use

Potential impacts identified were compared with the impacts identified in the Waste Disposition EA. The additional low-level waste is currently stored on property that is owned by DOE. Most of the land would continue to be used by DOE for storage or other undetermined uses. A portion of the waste is stored in DMSAs located in buildings leased to the U.S. Enrichment Corporation. DOE anticipates that when the material is removed from these DMSAs the areas may be used for other purposes by the U.S. Enrichment Corporation.

4.1.2 Socioeconomics and Environmental Justice

The Waste Disposition EA (November 2002) estimated a total employment increase of 45 jobs resulting from disposition of 11, 000 m^3 of waste. The disposition of 28,600 m^3 of waste and material is estimated to increase employment by 117 full-time-equivalent jobs per year. This would represent less than a 3% change from 1997 employment in McCracken County, which does not constitute a notable impact.

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations,” requires agencies to identify and address disproportionately high and adverse human health or environmental effects that their activities may have on minority and low-income populations. For the on-site activities considered in this EA Addendum, populations considered are those

that live within 80 km (50 miles) of the Paducah Site. For transportation alternatives, populations considered are those that live along the highways or rail lines where transport of packaged waste would occur and people using the highways and/or stopping at rest stops. Individual access and use of public highways or rest stops that would be used by trucks shipping waste are not limited or restricted to any particular population group, economically disadvantaged or advantaged. Because it is expected that the percentage of minority or low-income households within the potentially exposed population would vary along the highway routes used for the Proposed Action, no disproportionate effects to those minority or low-income households located along the routes can be identified. These groups would be subject to the same negligible impacts as the general population.

4.1.3 Transportation Impacts

For purposes of impact evaluation, DOE has established a "worst-case scenario" for the Proposed Action whereas all 28,600 m^3 is considered low-level radioactive waste requiring transportation off-site for treatment or disposal.

4.1.3.1 Highway Transport

Air Quality Impacts from Truck Transport

The Waste Disposition EA identified impacts based on the rate trucks pass through major metropolitan areas. The shipment rate used for the analysis was 762 shipments per year. The Proposed Action would have a higher shipment rate per year. The 17,600 m^3 of additional waste would be transported in shipments of 18.2 m^3 each, or a total of 967 shipments. If the removal of additional waste takes place uniformly over 10 years this would result in a shipment rate of 97 additional shipments per year. Therefore the annual shipment rate for all waste shipments would be 762 shipments originally proposed and 97 additional shipments resulting in 859 shipments per year. (Note that this is a worst-case scenario as the actual shipment rate would be less than 859 shipments per year because of the waste anticipated to be disposed on-site and the conservative rate used for analysis in the Waste Disposition EA.)

Analysis was undertaken to determine the impact of the proposed shipments relative to the threshold emission levels in nonattainment areas described by EPA in its air conformity regulations [40 *CFR* 93.153(b)(1)]. The EPA general conformity rule (58 *Federal Register* 63214, November 30, 1993) requires federal agencies to prepare a written conformity analysis and determination for proposed activities only in those cases where total emissions of an activity exceed the threshold emission levels. Where it can be demonstrated that emissions from a proposed new activity fall below the thresholds, these emissions are considered to be de minimus and require no formal analysis.

The Waste Disposition EA proposed routes were evaluated for the road miles proposed to be traveled for each criteria pollutant. Carbon monoxide, ozone, and particulate matter smaller than 10 micrometers (PM_{10}) were the criteria pollutants used. The maximum road miles traveled through a nonattainment area would be approximately 150 miles (includes return trip) through the Dallas-Fort Worth, Texas, area (Atlanta and St. Louis areas are nearly as large). This distance conservatively includes a return truck trip even though the return trip is not part of the Proposed Action (no waste on the truck), and it is likely that commercial vehicles would not return by the same route if they were able to contract a load for the return trip.

The EPA threshold for carbon monoxide for all nonattainment and maintenance areas is 200,000 lb (100 tons)/year for any new proposed activity. The EPA threshold for ozone (measured by its precursor, NO_x for "ozone attainment areas outside an ozone transport region" such as Dallas-Fort Worth) is 200,000 lb (100 tons)/year. The EPA threshold for PM_{10} for all moderate nonattainment areas is 200,000 lb (100 tons)/year for any new proposed activity. Emission factors for carbon monoxide and ozone for various motor vehicle types have been modeled for the year 1990. Emission factors for PM_{10} have been calculated using EPA's February 1995 model for that criteria pollutant. Heavy duty diesel-powered vehicles (HDDVs) are defined as any diesel-powered motor vehicle designated primarily for the transportation of property and rated at more than 8500 lb of gross vehicle weight. For HDDVs, including the standard commercial semi-tractor vehicles that would be used for pulling waste shipments, the average emission for carbon monoxide is estimated as 11.03 g/mile, while the NO_x (an ozone precursor) emission rate is 22.91 g/mile. Finally, the emission factor for PM_{10} is 14.87 g/mile.

Using a maximum of 859 shipments (truck round trips)/year, the carbon monoxide emission rate was estimated for the maximum distance traveled through a nonattainment area (Dallas-Fort Worth). This emission rate was approximately 3140 lb of carbon monoxide/year. This amount of emissions is below the threshold standard of 100 tons/year and is clearly a de minimus amount. Therefore, the deduction is made that the Proposed Action of 859 shipments per year would also be de minimus.

Using a maximum of 859 shipments/year (truck round trips), an ozone emission rate was established for the maximum distance traveled within a nonattainment area (Dallas-Fort Worth area). This emission rate was approximately 6503 lbs of NO_x/year (NO_x is a precursor to ozone). This amount of emissions is below the threshold standard of 100 tons/year and clearly a de minimus amount. Therefore, the deduction is made that the Proposed Action of 859 shipments per year would also be de minimus.

Finally, using a rate of 859 shipments/year, a PM_{10} rule was established for the maximum distance within a nonattainment area (Dallas-Fort Worth). The emission rate was 4225 lb of PM_{10}/year. This amount is below the threshold standard of 100 tons/year and is clearly a de minimus amount. Therefore, the deduction is made that the Proposed Action of 859 shipments per year would also be de minimus.

Because the Dallas-Fort Worth area example maximizes road miles traveled through a nonattainment area and also conservatively estimates emission factors, it is assumed that this example "bounds" the impacts within other nonattainment areas for the Proposed Action. Therefore, air emissions within all nonattainment areas along shipment routes are well below the EPA threshold emission levels, and thus require no formal conformity analysis.

Human Risk Associated with Truck Transport

The Waste Disposition EA estimated human risk impacts from truck transport on the basis of 762 shipments per year. The impacts with the additional waste are based on 859 total shipments per year. The impacts would be proportional to the ratio of the increase in shipments or 859 shipments (EA Addendum) / 762 shipments (Waste Disposition EA) = 1.13. Therefore the Waste Disposition EA quantified transportation impacts were multiplied by 1.13.

The radiological effects of the shipments are estimated by the potential latent cancer fatalities. Table 4.1 lists Waste Disposition EA impacts and the proportional cumulative impacts.

Table 4.1 Worst Case Radiological Impacts for Truck Shipments

Risk Group	Annual Impacts		Total for 10-year life cycle	
	Waste Disposition EA	EA Addendum	Waste Disposition EA	EA Addendum
	LCF	LCF	LCF	LCF
Crew	2.4×10^{-3}	2.7×10^{-3}	2.4×10^{-2}	2.7×10^{-2}
Population	1.2×10^{-3}	1.4×10^{-3}	1.2×10^{-2}	1.4×10^{-2}
MEI[a] (rem)	1.7×10^{-3}	1.9×10^{-3}	1.7×10^{-7}	1.9×10^{-7}

[a] MEI latent cancer fatality represents the probability of a latent cancer fatality occurrence
LCF = latent cancer fatality
MEI = maximally exposed individual

All latent cancer fatalities are less than one, therefore no fatalities would be anticipated.

Cargo-Related Radiological Impacts during a Highway Accident

The probability of a highway accident occurring during waste transportation by truck was evaluated for each of the receiving locations evaluated in the Waste Disposition EA. In addition, the radiological dose resulting from these accidents was calculated and the risk of latent cancer fatalities to the general public was also calculated. These results are summarized in Table 4.2.

Table 4.2 Cargo-Related Radiological Impacts from Truck Transportation Accident

	Waste Disposition EA	EA Addendum
Population Dose (person-rem)	4.9	5.5
Latent Cancer Fatalities	2.5×10^{-3}	2.8×10^{-3}

All latent cancer fatalities are less than one, therefore no fatalities would be anticipated.

Vehicle-Related Impacts

Potential vehicle-related impacts, including expected accidents, expected fatalities from accidents, and impacts from vehicle emissions were evaluated. The results of the evaluation are summarized in Table 4.3.

Table 4.3 Estimated Fatalities from Truck Emissions and Accidents (Vehicle-Related Impacts)

	Waste Disposition EA	EA Addendum
Total Accidents	1.89	2.14
Total Fatalities	0.08	0.09
Latent fatalities from emissions	0.43	0.49

All latent fatalities and accident fatalities are less than one, therefore no fatalities would be anticipated.

4.1.3.2 Rail Transport

Potential rail-related impacts, including expected accidents, expected fatalities from accidents, and impacts from vehicle emissions were evaluated. The results of the evaluation are summarized in Table 4.4

Table 4.4 Radiological Impacts from Rail Shipments

Risk Group	Annual Impacts		Total for 10-year life cycle	
	Waste Disposition EA	EA Addendum	Waste Disposition EA	EA Addendum
	LCF	LCF	LCF	LCF
Crew	1.1×10^{-3}	1.2×10^{-3}	1.1×10^{-2}	1.2×10^{-2}
Population	4.1×10^{-3}	4.6×10^{-3}	4.1×10^{-2}	4.6×10^{-2}
MEI[a] (rem)	3.7×10^{-8}	4.2×10^{-8}	3.7×10^{-7}	4.2×10^{-7}

[a] MEI latent cancer fatality represents the probability of a latent cancer fatality occurrence
LCF = latent cancer fatality
MEI = maximally exposed individual

All latent cancer fatalities are less than one, therefore no fatalities would be anticipated.

Cargo-Related Radiological Impacts during a Rail Accident

The probability of a railroad accident occurring during waste transportation was evaluated for each of the receiving locations evaluated in the Waste Disposition EA. In addition, the radiological dose resulting from these accidents was calculated and the risk of latent cancer fatalities to the general public was also calculated. These results are summarized in Table 4.5.

Table 4.5 Cargo-Related Radiological Impacts from Rail Transportation Accidents

	Waste Disposition EA	EA Addendum
Total Population Dose (person-rem)	5.51	6.2
Latent Cancer Fatalities	2.8×10^{-3}	3.2×10^{-3}

All latent cancer fatalities are less than one, therefore no fatalities would be anticipated.

Rail-Related Impacts

Potential rail-related impacts, including expected accidents and expected fatalities from accidents were evaluated. The results of the evaluation are summarized in Table 4.6.

Table 4.6 Estimated Fatalities from Accidents (Rail Related Impacts)

	Waste Disposition EA	EA Addendum
Total Accidents	0.08	0.09
Total Fatalities	0.02	0.02

All fatalities are less than one, therefore no fatalities would be anticipated.

4.1.3 Ecological Resources Impacts

Impacts to ecological resources were compared to the analysis in the Waste Disposition EA (DOE/EA-1339). The only potential change in impacts identified was for threatened and endangered species.

A Biological Assessment of impacts to threatened and endangered species prepared for the original Waste Disposition EA proposed action was revised for the proposed action of this environmental assessment addendum. The revised assessment is attached in Appendix C. The revised biological assessment concluded that the proposed action would be unlikely to adversely affect the Indiana bat or any mussel species of concern because:

- A potential for exposure of the bat and mussel species to waste as a result of an accident during implementation of the revised proposed action would be small and impacts would be negligible or nonexistent;
- Waste disposition activities are currently being performed at the Paducah Site with no known detriment to the local Indiana bat or mussel populations;

- No bat foraging or roosting habitat is present where waste handling activities would occur or along any proposed transportation routes. Therefore, no bat foraging or roosting habitat would be affected by routine waste disposition operations;
- The majority of mussel habitat in the area has been identified upstream from the Paducah site; no mussel habitat exists inside the site fence therefore no habitats would be affected by the revised proposed action;
- Bat foraging habitat (riparian vegetation along intermittent tributaries) present near the site of the revised proposed action is unlikely to become contaminated;
- Routine waste management operating procedures would provide minimal opportunity for direct exposure of local biota, including Indiana bats and their prey, to wastes. Procedure implementation would also decrease the probability of accidents; and
- No critical bat or mussel habitats are present at the Paducah Site. Therefore, no habitat alteration or destruction would occur as a result of the revised proposed action.

4.2 No Action Impacts

If DOE decides to take no action on the 17,600 m^3 of additional material, then it would remain on-site until disposition during D&D of each area that contains the material. These activities were analyzed as the Proposed Action in the Waste Disposition EA. Since the impacts have not changed it is not analyzed further.

4.3 Enhanced Storage Impacts

Under the Enhanced Storage Alternative, the additional material would remain on-site, be characterized to determine what portion is waste, and the waste would be stored in new or upgraded buildings designed to withstand earthquakes or other disasters. Storage of up to 28,600 m^3 of waste was included in the Enhanced Storage Alternative analysis in the Waste Disposition EA. Since the impacts have not changed it is not analyzed further.

5.0 Cumulative Impacts

Potential environmental cumulative impacts that could result from the proposed disposition of waste were compared with the impacts identified in the Waste Disposition EA. The disposition of all of the material as waste was included in the original analysis of cumulative impacts. Therefore, the cumulative impacts have not changed from those described in the Waste Disposition EA and are not addressed any further.

6.0 References

Final Environmental Assessment of Waste Disposition Activities at the Paducah Site Paducah Kentucky, DOE/EA-1339, November 2002.

Record of Decision (ROD) for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste, January 1998, 63 *Federal Register* 3629.

Environmental Assessment for the Construction, Operation, and Closure of the Solid Waste Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/EA-1046, March 1995.

The Environmental Assessment on the Implementation of the Authorized Limits Process for Waste Acceptance at the C-746-U landfill Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/EA-1414, August 2002.

DOE G 435.1-1, Implementation Guide for use with DOE M 435.1-1, Chapter IV Low-Level Waste Requirements, July 9, 1999.